

above line 6, insert

--Description of the Related Art--;

in lines 6-7, cancel "[1] and/or [2]" and substitute --G. Deco, C.

Schittenkopf and B. Schürmann, "Determining the information flow of dynamical  
5 systems from continuous probability distributions", Phys. Rev. Lett. 78, pages  
2345-2348, 1997 (Deco), and C. Schittenkopf and G. Deco, "Testing non-linear  
Markovian hypotheses in dynamical systems", Physica D104, pages 61-74, 1997  
(Schittenkopf)-- therefor;

in line 8, after "flow", insert --described in these references-- therefor;

10 in line 11, cancel "the" and substitute --such an-- therefor, and cancel  
"comprised therein";

in line 12, cancel "this leading thereto that" and substitute --allowing--  
therefor;

in line 13, cancel "is" and substitute --to be-- therefor;

15 in line 14, cancel "[3]" and substitute --J. Herz, A. Krogh, R. Palmer,  
"Introduction to the Theory of neural computation", Addison-Wesley, 1991  
(Herz)-- therefor;

above line 15, insert --SUMMARY OF THE INVENTION--;

20 in line 15, cancel "comprised in specifying" and substitute --to provide--  
therefor;

in lines 15-16, cancel ", first,", and before "implements", insert --then--;

cancel line 18, and substitute --This object is achieved by an arrangement  
for predicting an abnormality of a dynamic system and for implementing an action  
opposing the abnormality, comprising:

25 a) a measured data pick-up that registers comparison measured data of  
the system and test measured data of the system;

b) a processor unit, having a neural network that models the system,  
the processor:

(1) training the neural network using the comparison measured  
30 data;

- 5
- (2) determining a comparison information flow that describes a comparison dynamic of the system using the trained neural network;
- (3) determining a test information flow that describes a test dynamic of the system using the test measured data;
- 10
- (4) using the comparison information flow and of the test information flow, predicting the abnormality as established when the comparison information flow differs significantly from the test information flow and predicting the abnormality as not established when the comparison information flow does not significantly differ from the test information flow;
- 15
- (5) when the abnormality of the system has been predicted as established, then implementing the action; and
- c) an actuator that implements the action.

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This object is also achieved by a method for predicting an abnormality of a dynamic system and for implementing an action opposing the abnormality, comprising the steps of:

- 20
- a) measuring comparison measured data of the system and test measured data of the system;
- b) determining a neural network that models the system using of the comparison measured data;
- c) determining a comparison information flow that describes a comparison dynamic of the system using the neural network;
- 25
- d) determining a test information flow that describes a test dynamic of the system using the test measured data;
- e) comparing the comparison information flow to the test information flow using the comparison information flow and of the test information flow;

- f) determining the abnormality to be predicted as established when the comparison information flow differs significantly from the test information flow;
- g) determining the abnormality to be predicted as not established when the comparison information flow does not significantly differ from the test information flow; and
- h) implementing the action when the abnormality of the system has been predicted as established.

Finally, this object is achieved by a method for predicting an abnormality of a dynamic system, comprising the steps of:

- a) measuring comparison measured data of the system and test measured data of the system;
- b) determining a comparison information flow that describes a comparison dynamic of the system using the comparison measured data;
- c) determining a test information flow that describes a test dynamic of the system] using the test measured data;
- d) comparing the comparison information flow to the test information flow using the comparison information flow and of the test information flow;
- e) determining the abnormality to be predicted as established when the comparison information flow differs significantly from the test information flow;
- f) determining the abnormality to be predicted as not established when the comparison information flow does not significantly differ from the test information flow.-- therefor;

in line 20, cancel ". A" and substitute -- that has a-- therefor;  
in line 21, cancel "is provided therein";

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in line 22, cancel "unit is configured such that" and substitute --implements--  
- therefor, and cancel "are implemented";

in line 24, cancel "employed in order" and substitute --used-- therefor;

in line 27, cancel ";" and substitute --- therefor; and

5 in line 28, cancel "an" and substitute --An-- therefor, and cancel "thereby  
provided dependent" and substitute --provided in the arrangement that depends--  
therefor; *As*

**On page 2:**

10 in line 1, before "systematic", insert --to provide--, and cancel "and" and  
substitute --,-- therefor;

cancel line 2 and substitute to derive a solution of this general problem  
from it and to determine a quantity-- therefor; *A6*

in line 3, after "quantity", insert --)--;

in line 4, cancel "attack on" and substitute --abnormality in-- therefor;

15 in line 10, cancel "adequately general in order" and substitute --be general  
enough-- therefor;

in line 19, cancel "It is thereby to be taken into consideration" and  
substitute --One also considers-- therefor;

20 in line 21, cancel ", this being" and substitute --; this is-- therefor, and after  
"i.e.", insert --,--;

in line 22, cancel ",";

in line 23, cancel "is comprised therein that the" and substitute endlessly  
loops through-- therefor;

in line 24, cancel "form an endless loop";

25 in line 25, cancel "comprised therein that" and substitute --deals with the  
situation where-- therefor;

in line 26, after "dynamic", insert --value--;  
in line 27, cancel "comprised in" and substitute --comprised of-- therefor;  
in line 28, cancel "the noise" and substitute --this noise-- therefor; and  
in line 30, cancel "thereby" and cancel "on the basis of" and substitute --  
5 using-- therefor.

**On page 3:**

in line 1, cancel "is comprised therein that" and substitute --deals with a  
situation where-- therefor;  
in line 2, after "dynamic", insert --value--;  
10 cancel line 3 and substitute --The system may be excited, in reaction, with a  
regular signal. This can-- therefor; A7  
in line 4, cancel "ensue" and substitute --take place-- therefor;  
in line 5, cancel "on the basis of" and substitute --using-- therefor;  
cancel line 9 and substitute --Developments of the invention are discussed  
15 below.-- A8  
above line 10, insert --BRIEF DESCRIPTION OF THE DRAWINGS --;  
cancel line 12;  
in line 13, after "Figure 1", insert --is a block diagram showing--;  
in line 15, after "Figure 2", insert --is a block diagram showing--, and cancel  
20 "al" and substitute --, an-- therefor;  
in line 17, before "steps", insert --is a flowchart showing-- and cancel "the";  
above line 18, insert --DESCRIPTION OF THE PREFERRED  
EMBODIMENTS--; and  
in line 23, cancel "and processed thereat" and substitute --where they are  
25 processed--.

**On page 4:**

in line 1, cancel "Let it thereby be noted that the" and substitute --The-- therefor;

5 in lines 7-8, cancel "Via the interface 201, this" and substitute --This-- therefor;

in line 8, after "PRE", insert --, via the interface 201,--;

in line 10, cancel "Further" and substitute --Furthermore-- therefor, and cancel "AKT2," and substitute --AKT2.-- therefor;

10 in line 11, cancel "this" and substitute --This-- therefor, and cancel "applying" and substitute --applies-- therefor;

in line 12, cancel "thereby";

cancel lines 17-25 and substitute

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-- A neural network NN is trained as follows. Both comparison data and test data are measured using the measured data pick-up MDA in process 302. The  
15 neural network NN is modeled based on the comparison measured data in process 304. This modeling is used to demarcate normal operation from abnormal operation, and permits a later determination of whether newly measured data indicates an abnormality in the system. After the end of the training, information flows according to Deco or Schittenkopf are evaluated. A comparison information  
20 flow describing a comparison dynamic of the system is determined using the trained neural network NN in process 306. A test information flow describing a test dynamic of the system is determined using the test measured data in process 308. A comparison as to whether the test information flow differs significantly, according to some predetermined criteria, from the comparison information flow is  
25 performed in decision 310. If the comparison difference is significant, this is indicative of an abnormality that is predicted--such an abnormality of the system can be indicated on the basis of this information flow before the occurrence of this abnormality. When a predicted abnormality is established, an action that opposes an occurrence of the abnormality is implemented in process 312, and a branch is  
30 made preferably to process 306. If the comparison difference is not significant,

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then the predicted abnormality is not established, and no action is implemented; a branch is made preferably to process 306. } therefor;

in line 26, cancel "these illustrating" and substitute --that illustrate-- therefor.

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**On page 5:**

in line 3, cancel "is comprised therein that" and substitute --occurs when-- therefor;

in line 5, before "training", insert --the--, and cancel "It should";

in line 6, cancel "thereby be noted that the" and substitute --The-- therefor;

10

in line 7, cancel "at the" and substitute --at a particular-- therefor;

in line 9, cancel "the person" and substitute --a person--, cancel "should" and substitute --, are--, and cancel "be";

in line 17, cancel ", preferably the human brain," and substitute --(e.g., a human brain)-- therefor;

15

in line 19, cancel "thereto. Thus, an" and substitute --to them. An-- therefor;

in line 22, cancel "thereto" and substitute --to this-- therefor;

in line 23, after "i.e.", insert --,--;

in line 30, cancel "We shall turn to the" and substitute --The-- therefor; and

20

cancel line 31 and substitute attack is presented below for more in-depth discussion-- therefor. A10

**On page 6:**

in line 3, cancel "[2]" and substitute --Schittenkopf-- therefor;

in line 4, cancel "form" and substitute --from-- therefor;

25

in line 5, cancel "surround of the" and substitute --area of-- therefor;

in line 11, cancel "whereby" and substitute --where-- therefor;

in line 12, cancel "..." and substitute -- $x_{t-1}, \dots, x_{t-n}$ -- therefor;

in line 16, cancel "[4]" and substitute ~~+~~G. Deco, D. Obradovic, "An  
Information-Theoretic Approach to Neural Computing", Springer-Verlag, 1996,  
Chapter 7.2 (Obradovic)-- therefor; A11

5 in line 18, cancel "whereby" and substitute --where-- therefor, and cancel  
"[sic]";

in line 23, cancel "thereto" and substitute --to it-- therefor; and  
in line 27, cancel "[2]" and substitute --Schittenkopf-- therefor.

**On page 7:**

10 in line 1, cancel "[1] and[2]" and substitute --Deco and Schittenkopf--  
therefor, and after "i.e.", insert --,--;

in line 3, cancel "thus", and cancel "whereby" and substitute --where--  
therefor;

in line 4, after "i.e.", insert --,--;

15 in line 9, cancel "thereby to test" and substitute --to test, in this analysis,--  
therefor;

in line 12, after "i.e.", insert --,--;

in line 22, cancel "[5]" and substitute ~~+~~B. Gluckmann, E. Neel, T. Netoff,  
W. Ditto, M. Spano, S. Schiff, "Electric field suppression of epileptiform activity in  
hippocampal slices", Journal of Neurophysiology 76, pages 4202-4205, 1996  
20 (Gluckmann)-- therefor; A12

in line 26, after "i.e.", insert --,--; and

in line 27, cancel " , the brain in this case" and substitute --(the brain, in this  
case)-- therefor.

**On page 8:**

25 in line 7, after "brain,", insert --and--;

in line 8, cancel "thus";

in line 9, cancel “, whereby” and substitute by the inventive system in  
which-- therefor; *A13*

in line 10, cancel “Dependent of” and substitute --Depending on-- therefor;

in line 11, cancel “is comprised” and substitute --may be-- therefor, cancel

5 the first “in” and after “chaotic”, insert --field--;

in line 14, cancel “whereby” and substitute --in which-- therefor;

in line 16, cancel “It is thereby expedient to” and substitute --The methods  
then” therefor”;

in line 18, before”of the”, insert --e.g.,--;

10 in line 19, cancel “this” and substitute --the abnormality-- therefor;

in line 23, cancel “expedient” and substitute --necessary-- therefor;

in line 26, after “example”, insert --,--;

in line 27, cancel “the greatest” and substitute --a great-- therefor, and  
cancel “whereby” and substitute --and where-- therefor; and

15 below line 28, insert

-- The above-described method is illustrative of the principles of the present  
invention. Numerous modifications and adaptations thereof will be readily apparent  
to those skilled in this art without departing from the spirit and scope of the *At*  
present invention.--.

20 **Delete page 9.**

**IN THE CLAIMS:**

**On substitute page 10:**

line 1, replace “Patent Claims” with --WHAT IS CLAIMED IS:--.